

Materials Science

INVESTIGATION OF IRON-OXIDE NANOPARTICLES SYNTHESIZED IN POLYSTYRENE RESIN MATRIX

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Magnetic nanoparticles have potential applications ranging from targeted drug delivery and imaging in the medical field to sensing and memory storage in technology. The preparation, structure and physical properties of iron oxide based nanoparticles synthesized by ion exchange in a polystyrene resin have been investigated. By employing a synthesis method originally developed by Ziolo et al, nanoparticles were prepared in a sulfonated divinyl benzene polystyrene matrix using various salt solutions of FeCl_2 and FeCl_3 as well as combinations of FeCl_2 and FeCl_3 . Powder x-ray diffraction (XRD) was used to identify the different phases present and identify average particle size while Transmission Electron Microscopy (TEM) was used to determine particle morphology and particle size distribution. SQUID magnetization measurements show a super- paramagnetic behavior with blocking temperatures (T_B) varying from 20 K to room temperature. This data led to the conclusion that not only does the number of reactions performed have an effect on the particle size, but the salt solution used also influences the particle size given both FeCl_2 and FeCl_3 solutions resulted in $\gamma\text{-Fe}_2\text{O}_3$ particles within the resin. The nanoparticles produced with only FeCl_2 were larger and have a broader particle size distribution than those prepared using FeCl_3 .